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# 1 [Modeling and rendering: Pareto based optimization of multi-resolution geometry for](#)


[real time rendering](#)

Nicolaas Tack, Gauthier Lafruit, Francky Catthoor, Rudy Lauwereins

 March 2005 **Proceedings of the tenth international conference on 3D Web technology**

Publisher: ACM Press

 Full text available: pdf (791.36 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

This paper proposes a view-dependent quality-cost trade-off decision-taking framework for time-critical multi-resolution rendering. The paper extends existing surface to surface error metrics to a view-dependent accuracy heuristic, used in an off-line process for establishing a representative set of elementary accuracy-cost trade-off curves. These so-called Pareto plots are combined at run-time according to the object meshes visibility and importance (e.g. object distance) for proper global view ...

**Keywords:** MPEG-4 WSS, cost-benefit, pareto optimization

# 2 [Graphics/image-based algorithms: The randomized sample tree: a data structure for](#)


[interactive walkthroughs in externally stored virtual environments](#)

Jan Klein, Jens Krokowski, Matthias Fischer, Michael Wand, Rolf Wanka, Friedhelm Meyer auf der Heide

 November 2002 **Proceedings of the ACM symposium on Virtual reality software and technology**

Publisher: ACM Press

 Full text available: pdf (1.76 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We present a new data structure for rendering highly complex virtual environments of arbitrary topology. The special feature of our approach is that it allows an interactive navigation in very large scenes (30 GB/400 million polygons in our benchmark scenes) that cannot be stored in main memory, but only on a local or remote hard disk. Furthermore, it allows interactive rendering of substantially more complex scenes by instantiating objects. For the computation of an approximate image of the scene ...


**Keywords:** Monte Carlo techniques, level of detail algorithms, out-of-core rendering, point sample rendering, rendering systems, spatial data structures

3 Enabling level-of-detail matching for exterior scene synthesis

Randy K. Scoggins, Robert J. Moorhead, Raghu Machiraju

October 2000 **Proceedings of the conference on Visualization '00**

**Publisher:** IEEE Computer Society Press

Full text available:  pdf(307.15 KB) Additional Information: [full citation](#), [citations](#), [index terms](#)

**Keywords:** image metrics, level-of-detail, multiresolution model, perception, rendering, terrain visualization

4 Large models & large displays: Far voxels: a multiresolution framework for interactive rendering of huge complex 3D models on commodity graphics platforms

Enrico Gobbetti, Fabio Marton

July 2005 **ACM Transactions on Graphics (TOG)**, Volume 24 Issue 3

**Publisher:** ACM Press

Full text available:  pdf(809.05 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

We present an efficient approach for end-to-end out-of-core construction and interactive inspection of very large arbitrary surface models. The method tightly integrates visibility culling and out-of-core data management with a level-of-detail framework. At preprocessing time, we generate a coarse volume hierarchy by binary space partitioning the input triangle soup. Leaf nodes partition the original data into chunks of a fixed maximum number of triangles, while inner nodes are discretized into ...


**Keywords:** level of detail, out-of-core algorithms

5 Perceptually-driven decision theory for interactive realistic rendering

Reynald Dumont, Fabio Pellacini, James A. Ferwerda

April 2003 **ACM Transactions on Graphics (TOG)**, Volume 22 Issue 2

**Publisher:** ACM Press

Full text available:  pdf(471.75 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

In this paper we introduce a new approach to realistic rendering at interactive rates on commodity graphics hardware. The approach uses efficient perceptual metrics within a decision theoretic framework to optimally order rendering operations, producing images of the highest visual quality within system constraints. We demonstrate the usefulness of this approach for various applications such as diffuse texture caching, environment map prioritization and radiosity mesh simplification. Although he ...

**Keywords:** Human vision, perceptually-based rendering, visual perception

6 Session P14: terrain rendering: QuadTIN: quadtree based triangulated irregular networks

Renato Pajarola, Marc Antonijuan, Roberto Lario

October 2002 **Proceedings of the conference on Visualization '02**

**Publisher:** IEEE Computer Society

Full text available:  pdf(3.31 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)


Interactive visualization of large digital elevation models is of continuing interest in scientific visualization, GIS, and virtual reality applications. Taking advantage of the regular structure of grid digital elevation models, efficient hierarchical multiresolution

triangulation and adaptive level-of-detail (LOD) rendering algorithms have been developed for interactive terrain visualization. Despite the higher triangle count, these approaches generally outperform mesh simplification methods t ...

**Keywords:** level-of-detail, multiresolution triangulation, real-time terrain visualization, triangulated irregular networks

- 7 [IEEE Visualization Cumulative Bibliography \(1990 - 2004\)](#)  
October 2004 **Proceedings of the conference on Visualization '04**

**Publisher:** IEEE Computer Society

Full text available:  [pdf\(811.24 KB\)](#) Additional Information: [full citation](#)



- 8 [Large meshes and GPU programming: Adaptive tetrapuzzles: efficient out-of-core construction and visualization of gigantic multiresolution polygonal models](#)

Paolo Cignoni, Fabio Ganovelli, Enrico Gobbetti, Fabio Marton, Federico Ponchio, Roberto Scopigno

August 2004 **ACM Transactions on Graphics (TOG)**, Volume 23 Issue 3

**Publisher:** ACM Press

Full text available:  [pdf\(525.88 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)  
 [mov\(23:54 MIN\)](#)



We describe an efficient technique for out-of-core construction and accurate view-dependent visualization of very large surface models. The method uses a regular conformal hierarchy of tetrahedra to spatially partition the model. Each tetrahedral cell contains a precomputed simplified version of the original model, represented using cache coherent indexed strips for fast rendering. The representation is constructed during a fine-to-coarse simplification of the surface contained in diamonds (sets ...


**Keywords:** Level of Detail, Out-Of-Core Algorithms

- 9 [Isosurface extraction techniques for Web-based volume visualization](#)

Klaus Engel, Rüdiger Westermann, Thomas Ertl

October 1999 **Proceedings of the conference on Visualization '99: celebrating ten years**

**Publisher:** IEEE Computer Society Press

Full text available:  [pdf\(2.16 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)



The reconstruction of isosurfaces from scalar volume data has positioned itself as a fundamental visualization technique in many different applications. But the dramatically increasing size of volumetric data sets often prohibits the handling of these models on affordable low-end single processor architectures. Distributed client-server systems integrating high-bandwidth transmission channels and Web-based visualization tools are one alternative to attack this particular problem, but theref ...

**Keywords:** Web-based applications, distributed systems, isosurface reconstruction, volume visualiation

- 10 [Planet-Sized Batched Dynamic Adaptive Meshes \(P-BDAM\)](#)

Paolo Cignoni, Fabio Ganovelli, Enrico Gobbetti, Fabio Marton, Federico Ponchio, Roberto Scopigno




**October 2003 Proceedings of the 14th IEEE Visualization 2003 (VIS'03) VIS '03****Publisher:** IEEE Computer SocietyFull text available:  [pdf\(739.54 KB\)](#) Additional Information: [full citation](#), [abstract](#)

We describe an efficient technique for out-of-core management and interactive rendering of planet sized textured terrain surfaces. The technique, called P-Batched Dynamic Adaptive Meshes (P-BDAM), extends the BDAM approach by using as basic primitive a general triangulation of points on a displaced triangle. The proposed framework introduces several advances with respect to the state of the art: thanks to a batched host-to-graphics communication model, we outperform current adaptive tessellation ...

**Keywords:** Multiresolution, terrains, huge dataset**11 Session P14: terrain rendering: Horizon occlusion culling for real-time rendering of hierarchical terrains**


Brandon Lloyd, Parris Egbert

**October 2002 Proceedings of the conference on Visualization '02****Publisher:** IEEE Computer SocietyFull text available:  [pdf\(886.98 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


We present a technique to perform occlusion culling for hierarchical terrains at run-time. The algorithm is simple to implement and requires minimal pre-processing and additional storage, yet leads to 2-4 times improvement in framerate for views with high degrees of occlusion. Our method is based on the well-known occlusion horizon algorithm. We show how to adapt the algorithm for use with hierarchical terrains. The occlusion horizon is constructed as the terrain is traversed in an approximate f ...

**Keywords:** occlusion culling, rendering algorithms, visibility**12 LOD-sprite technique for accelerated terrain rendering**

Baoquan Chen, J. Edward Swan, Eddy Kuo, Arie Kaufman

**October 1999 Proceedings of the conference on Visualization '99: celebrating ten years****Publisher:** IEEE Computer Society PressFull text available:  [pdf\(367.63 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We present a new rendering technique, termed LOD-sprite rendering, which uses a combination of a level-of-detail (LOD) representation of the scene together with reusing image sprites (previously rendered images). Our primary application is accelerating terrain rendering. The LOD-sprite technique renders an initial frame using a high-resolution model of the scene geometry. It renders subsequent frames with a much lower-resolution model of the scene geometry ...

**Keywords:** acceleration techniques, image-based modeling rendering, level of detail, multi-resolution, terrain rendering, texture mapping, virtual environments, virtual reality**13 Rendering: Texture mapping for view-dependent rendering** Mario Sormann, Christopher Zach, Konrad Karner**April 2003 Proceedings of the 19th spring conference on Computer graphics****Publisher:** ACM PressFull text available:  [pdf\(450.87 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#)

View-dependent multiresolution meshes allow smooth interactive animation and optionally time-critical rendering of huge geometric data-sets and are therefore an important tool for large-model visualization. So far most view-dependent rendering frameworks are restricted to models with a topologically simple texture mapping. Our approach overcomes this restriction with a new texturing technique, which allows texture mapping during the runtime simplification process. In fact, novel algorithm genera ...



**Keywords:** level of detail, multiresolution meshes, real-time rendering, texture atlas, texture generation, texture mapping

14 Automated Generation of Visual Simulation Databases Using Remote Sensing and GIS

Martin Suter, D. Nuesch

October 1995 **Proceedings of the 6th conference on Visualization '95**

**Publisher:** IEEE Computer Society

Full text available:  [pdf\(1.15 MB\)](#)  Additional Information: [full citation](#), [abstract](#), [citations](#)  
[Publisher Site](#)

This paper reports on the development of a strategy to generate databases used for real-time interactive landscape visualization. The database construction from real world data is intended to be as automated as possible. The primary sources of information are remote sensing imagery recorded by Landsat's Thematic Mapper (TM) and digital elevation models (DEM). Additional datasets (traffic networks and buildings) are added to extend the database. In a first step the TM images are geocoded and then ...


**Keywords:** remote sensing, geographic information systems, geographic databases, satellite images, classification, visual simulation, level of detail

15 Haptics: Haptics-based volumetric modeling using dynamic spline-based implicit functions

Jing Hua, Hong Qin

October 2002 **Proceedings of the 2002 IEEE symposium on Volume visualization and graphics**

**Publisher:** IEEE Press

Full text available:  [pdf\(5.78 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

This paper systematically presents a novel haptics-based volumetric modeling framework, which is founded upon volumetric implicit functions and powerful physics-based modeling. The volumetric implicit functions incorporate hierarchical B-splines, CSG-based functional composition, and knot insertion to facilitate multiresolution editing and level of details (LODs) control. Our dynamic volumes are semi-algebraic sets of implicit functions and are governed by the principle of dynamics, hence respon ...

16 1-1 Rendering: Hybrid representations to improve both streaming and rendering of dynamic networked virtual environments

Tom Jehaes, Peter Quax, Patrick Monsieurs, Wim Lamotte

June 2004 **Proceedings of the 2004 ACM SIGGRAPH international conference on Virtual Reality continuum and its applications in industry**

**Publisher:** ACM Press

Full text available:  [pdf\(435.21 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

In this paper we present a novel combined usage of image-based and geometrical representations in dynamic networked virtual environments. Contrary to other research,

the type of applications we focus on rely on a continuous streaming of representation data as the user navigates through the virtual environment. The client has no prior knowledge of the environment that needs to be rendered and the objects in the environment can be dynamic or static. Our first goal is to present the user with a suf ...

**Keywords:** geometry simplification, image-based rendering, level of detail, networked virtual environments, streaming

17 Capture from images: Protected interactive 3D graphics via remote rendering



David Koller, Michael Turitzin, Marc Levoy, Marco Tarini, Giuseppe Croccia, Paolo Cignoni, Roberto Scopigno

August 2004 **ACM Transactions on Graphics (TOG)**, Volume 23 Issue 3

**Publisher:** ACM Press

Full text available:  [pdf\(368.19 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Valuable 3D graphical models, such as high-resolution digital scans of cultural heritage objects, may require protection to prevent piracy or misuse, while still allowing for interactive display and manipulation by a widespread audience. We have investigated techniques for protecting 3D graphics content, and we have developed a remote rendering system suitable for sharing archives of 3D models while protecting the 3D geometry from unauthorized extraction. The system consists of a 3D viewer clien ...

**Keywords:** 3D models, digital rights management, remote rendering, security

18 Post-rendering 3D warping



William R. Mark, Leonard McMillan, Gary Bishop

April 1997 **Proceedings of the 1997 symposium on Interactive 3D graphics**

**Publisher:** ACM Press

Full text available:  [pdf\(1.41 MB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)


19 Sort-First, Distributed Memory Parallel Visualization and Rendering



E. Wes Bethel, Greg Humphreys, Brian Paul, J. Dean Brederson

October 2003 **Proceedings of the 2003 IEEE Symposium on Parallel and Large-Data Visualization and Graphics PVG '03**

**Publisher:** IEEE Computer Society

Full text available:  [pdf\(310.79 KB\)](#) Additional Information: [full citation](#), [abstract](#)

While commodity computing and graphics hardware has increased in capacity and dropped in cost, it is still quite difficult to make effective use of such systems for general-purpose parallel visualization and graphics. We describe the results of a recent project that provides a software infrastructure suitable for general-purpose use by parallel visualization and graphics applications. Our work combines and extends two technologies: Chromium, a stream-oriented framework that implements the OpenGL ...

**Keywords:** distributed memory visualization, parallel visualization, parallel scene graph

20 Volume rendering II: View-dependent multiresolution splatting of non-uniform data



Justin Jang, William Ribarsky, Christopher D. Shaw, Nickolas Faust

May 2002 **Proceedings of the symposium on Data Visualisation 2002 VISSYM '02**

**Publisher:** Eurographics Association

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index](#)

Full text available:  pdf(663.32 KB)[terms](#)

This paper develops an approach for the splat-based visualization of large scale, non-uniform data. A hierarchical structure is generated that permits detailed treatment at the leaf nodes of the non-uniform distribution. A set of levels of detail (LODs) are generated based on the levels of the hierarchy. These yield two metrics, one in terms of the spatial extent of the bounding box containing the splat and one in terms of the variation of the scalar field over this box. The former yields a view ...

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